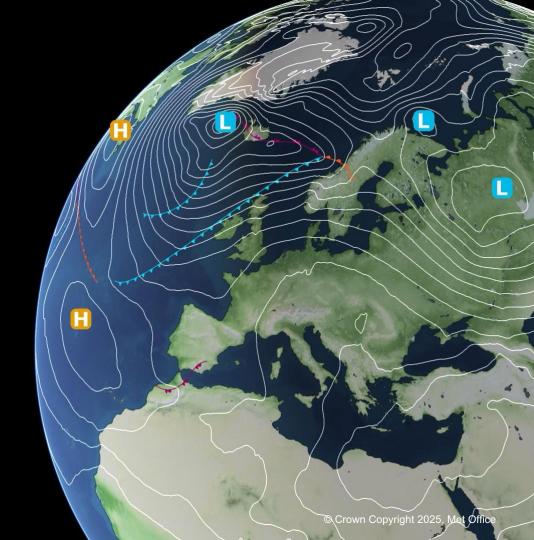


# Met Office Update

WGNE40

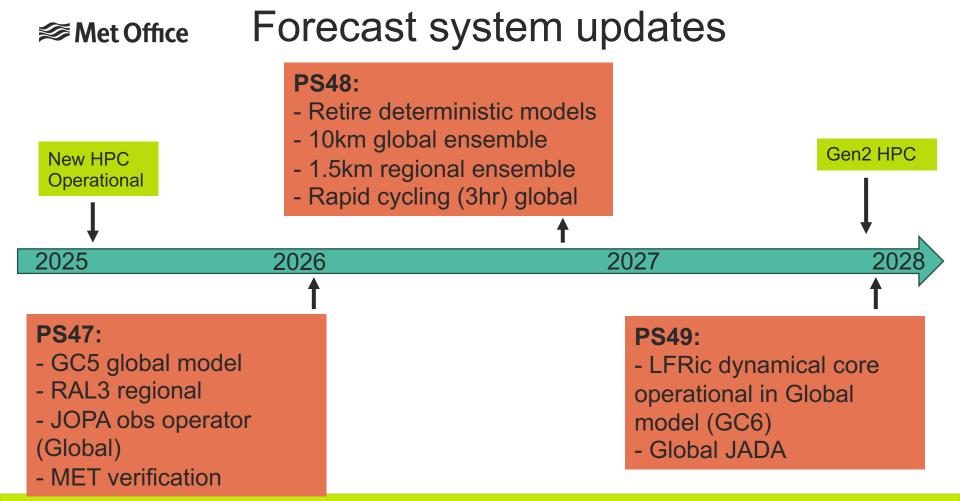
Tim Graham





### Contents

- Timeline of planned upgrades
- Highlights from PS47
  - Global
  - Regional
- Further ahead:
  - Status of GC6 (the first LFRic based global model)





### Global Model

- NEMO 4.0.4 & SI3 (replacing CICE)
- Convection improvements
  - Including "Fountain Buster"
- Bi-modal cloud initialisation
- Improved stability due to blended orography (ensemble timestep increased from 5mins to 7.5mins)

- JOPA obs operator
- Tuning of SPT and Bias correction improves CRPS (RMSE and spread).

# Met Office Global summary (MOGREPS-G)

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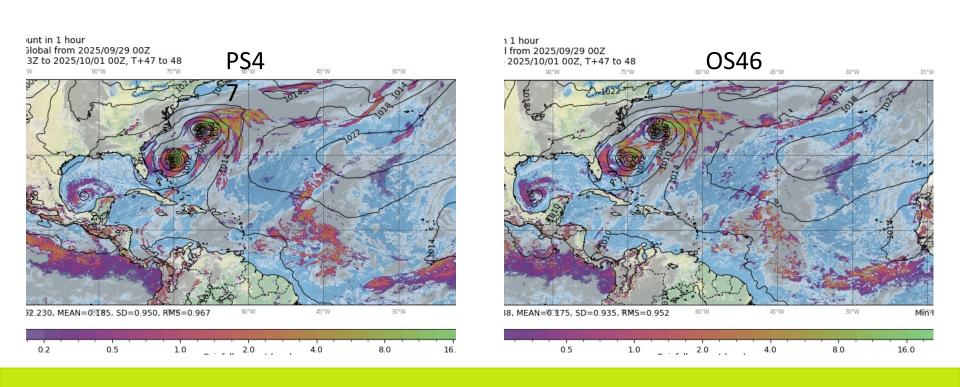
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### Forecasts of Hurricane Humberto & Imelda



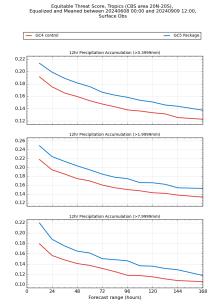


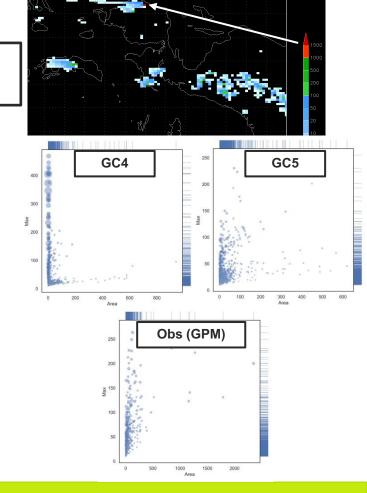
#### **GC5** Precipitation

high-res trial July-Oct 2022

- Precipitation ETS improved in GC5 at all thresholds
- Fountain-buster scheme has eliminated unrealistic heavy spot values of precipitation
- Convection is more organised (next slide)

GC4: 1500mm from large-scale precip in 12 hours!





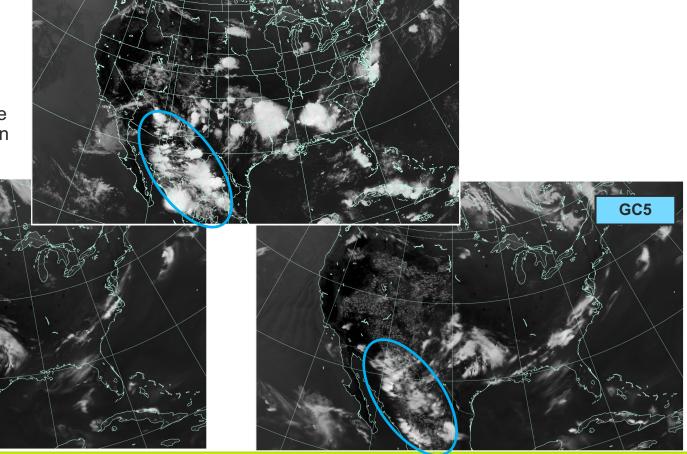


GC4

# Simulated satellite imagery

OBS

GC5 has deeper and more organised deep convection





### RAL3 details

Bi-modal cloud scheme (Kwinten van Weverberg)

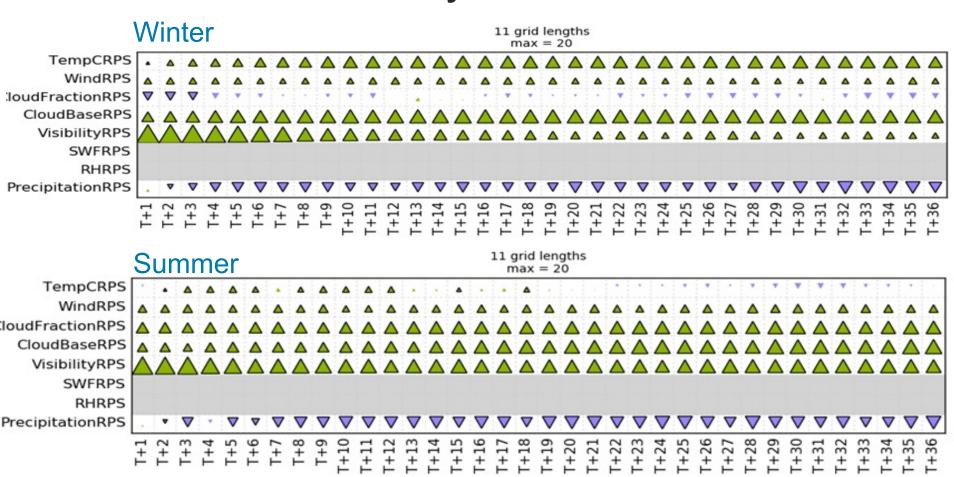
Van Weverberg et al., 2021: https://doi.org/10.1175/MWR-D-20-0224.1 and https://doi.org/10.1175/MWR-D-20-0230.1

- based on Smith cloud scheme previously used in mid-latitude RAL
- replaces Smith scheme in RAL2-M and prognostic PC2 scheme in the tropical version RAL2-T
- CASIM multi-moment cloud microphysics scheme (Adrian Hill, Paul Field, Kalli Furtado)

Shipway and Hill, 2012 - https://doi.org/10.5194/acp-18-14253-2018, Miltenberger et all, 2018 - https://doi.org/10.5194/acp-18-3119-2018

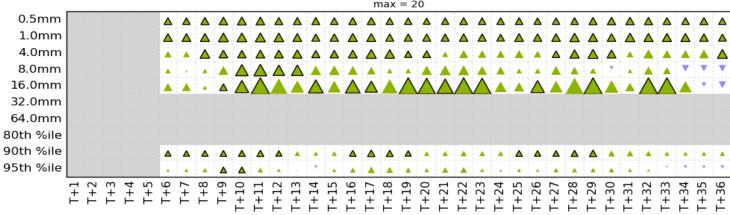
- Cloud AeroSol Interacting Microphysics
- · permits the UM to have single or double moments microphysical capability
- stochastic boundary layer perturbations in mid-latitude configuration no longer needed (Adrian Lock)
- and many more...
- No longer need different configurations for tropics and mid-latitudes!

# Met Office UK summary



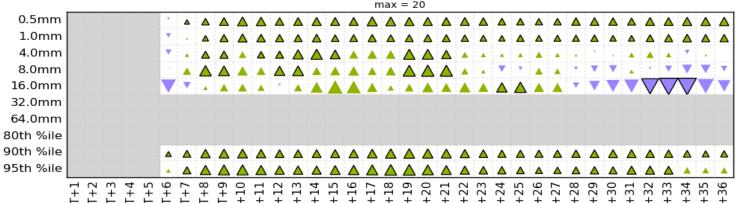
#### 

25 grid lengths max = 20



Winter

25 grid lengths max = 20



Summer

### **Met Office** 10<sup>th</sup> June 2023 (6 hr forecast)

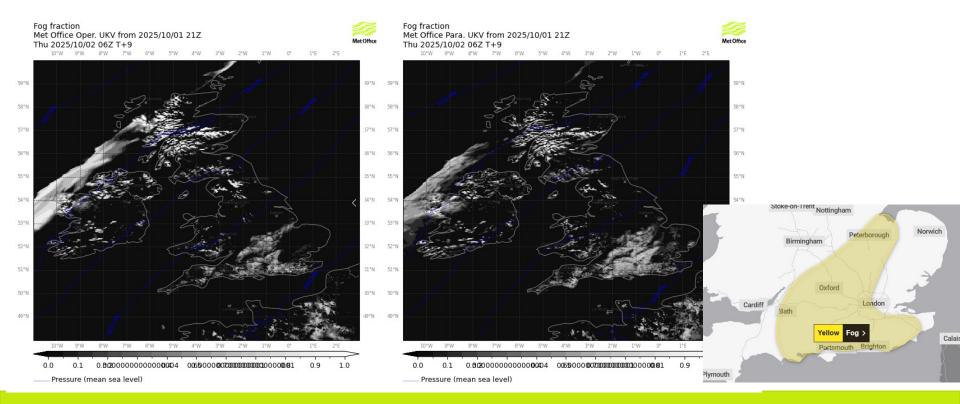
Radar observation **OS46 PS47** Instantaneous Precipitation Rate Instantaneous Precipitation Rate Met Office UKV RAL3.1 L70 from 2023/06/10 06Z Met Office UKV RA2M from 2023/06/10 06Z Sat 2023/06/10 12Z T+6 Min Pmsl: 1009.95 hPa MIN=0.000, MAX=48.766, MEAN=0.093, SD=0.646, RMS=0.653 Min Pmsl: 1009.86 hPa 2.0 Precipitation Rate (mm hr<sup>-1</sup>) 2.0 Precipitation Rate (mm hr<sup>-1</sup>) 4 Total Cloud Fraction (Octas) 4 Total Cloud Fraction (Octas ——— Pressure (mean sea level) - Pressure (mean sea level)

Front not coherent; rainfall too intense in patches

Spurious showers

#### **Met Office**

# Fog fraction case study





### **Future Models**



## The first LFRic based coupled model – GC6

- Target to freeze model by February 2026
- Must match performance of GC5 in both scientific performance (NWP and climate) and model cost

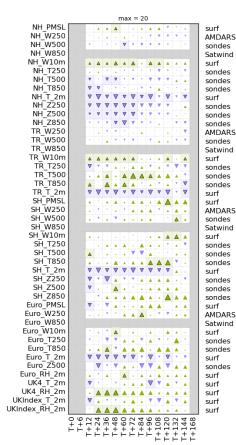




### NWP performance

- Caution: Very small sample size
- Small improvement in scores compared to GC5 (when compared to observations)

% Difference (GC6\_beta2 vs. GC5) - overall 0.24%, RMSE against observations for Equalized, 20210324 12:00 to 20210803 00:00





## Summary

- First scientific update to operational suite since 2022 expected to go live in January (weather permitting)
  - Expect significant improvements to regional and global forecasts
  - Hope to see an improvement to tropical cyclone forecasts after the degradation seen in PS45
- Move to 10km global ensemble forecast around end 2026
- Making good progress with development of LFRic based coupled model for PS49